

## CHAPTER 3. PROPOSED ACTION AND ALTERNATIVES

The regulations of the Council on Environmental Quality (CEQ; 40 CFR 1500-1508) direct Federal agencies to use the process established by the National Environmental Policy Act (NEPA) to identify and assess reasonable alternatives to proposed actions that would avoid or minimize adverse effects on the quality of the human environment [40 CFR 1500.2(e)]. This chapter describes the No-Action Alternative and two other alternatives that span the range of reasonable alternatives for the shut-down of the River Water System at the Savannah River Site (SRS).

- No Action – The U.S. Department of Energy (DOE) would continue its present course of action, which it established through the NEPA process during the preparation of the environmental assessment (EA) and Finding of No Significant Impact for *Natural Fluctuation of Water Level in Par Pond and Reduced Water Flow in Steel Creek Below L-Lake at the Savannah River Site* (DOE 1995a,b). Using the small pump described in Chapter 1, DOE would continue to pump water from the Savannah River to provide fire protection at K- and L-Reactors and blend flow into L-Area Sanitary Waste Plant effluent. In addition, DOE would pump water to L-Lake to maintain its full pool [190 feet (57.9 meters) above mean sea level]. DOE would also retain the capability to pump river water to Par Pond to prevent water levels from falling below 195 feet (59.4 meters) above mean sea level and to ensure that Steel Creek and Lower Three Runs received discharges no less than 10 cubic feet (0.28 cubic meter) per second. Section 3.1 contains a more detailed discussion of this alternative. | TE
- Shut Down and Deactivate the River Water System – DOE would shut down and deactivate the River Water System and place it in a secure, environmentally satisfactory condition. This means that DOE could not

pump river water to L-Lake, Par Pond, or to other current or future potential users of the system. Par Pond is expected to maintain a water level greater than 195 feet (59.4 meters) above mean sea level, and Lower Three Runs would receive minimum discharge of 10 cubic feet (0.28 cubic meter) per second. No surveillance or maintenance of the pump and piping system would be performed. The only water input both lakes would receive would come from natural recharge from the environment. The water level of L-Lake would fall to the original conditions of Steel Creek. Section 3.2 contains a more detailed discussion of this alternative.

- Shut Down and Maintain the River Water System – This is DOE's Proposed Action and Preferred Alternative. DOE would maintain the River Water System in a standby condition, which would include the ability to restart the system if environmental degradation/remediation or other future conditions or missions dictated such a need. With the exception of one layout scheme described in Section 3.3.2, L-Lake would subside to the original Steel Creek conditions. Par Pond would still be maintained at 195 to 200 feet (59.4 to 61.0 meters) above mean sea level, and flow in Lower Three Runs would be maintained at 10 cubic feet (0.28 cubic meter) per second. The remaining streams would receive natural flows from their respective watersheds. Section 3.3 contains a more detailed discussion of this alternative. | TC

The information that DOE used to develop specific actions that would be involved in implementing the alternatives consisted of:

- Engineering studies that examined the effects of the shutdown of the River Water System on system structures, equipment, and piping, and the costs associated with a range of layout options | TE

- Extensive analyses of aerial radiological surveys, radiological sampling of the sediments on the surface of the L-Lake lakebed, and deeper core sampling of the L-Lake lakebed
- Human health and ecological documentation from the early 1990s through 1996
- Studies of water and sediment chemistry, transport properties, effects of fluctuating water levels, fish communities, and vegetation
- Geological and hydrological studies of L-Lake, Par Pond, and the onsite streams conducted primarily in the 1990s
- NEPA and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) documentation for Par Pond and L-Lake

DOE also recognizes that there are potential future uses of the River Water System. However, water requirements are not part of the scope or alternatives in this environmental impact statement (EIS) but would be examined in the NEPA review of the project or projects that would use the River Water System.

DOE eliminated several alternatives from the River Water System analysis as unreasonable, including options to maintain the surface of L-Lake at an intermediate level that would promote natural fluctuation. Another option was pumping of water from Par Pond through existing piping to P-Reactor and into L-Lake through Steel Creek. DOE eliminated this alternative on

the basis of both cost and uncertainty that Par Pond would have sufficient supply to maintain L-Lake and Par Pond levels. These alternatives are not consistent with the need for DOE action (i.e., to reduce costs by shutting down the River Water System). Maintaining permanent water level in L-Lake would require the use of the River Water System.

DOE also eliminated an alternative that would have used the River Water System to pump to Par Pond to maintain nutrient inputs to the ecosystem and to minimize exposures to contaminated sediments. The extent of lakebed contamination in Par Pond is well documented [about two-thirds of the contaminated sediments in the lakebed are below the 189-foot (57.6-meter) level], and environmental impacts would occur if the lake level fell below 195 feet (59.4 meters) above mean sea level (DOE 1995a). However, studies and analyses conducted from 1991 to 1996 indicate that the lake would fluctuate but maintain its level well above 195 feet (59.4 meters) above mean sea level (Gladden 1996a). The continuation of pumping to Par Pond was part of the No-Action Alternative that DOE described in the Par Pond EA (DOE 1995a). In August 1995, DOE implemented the proposed action described in the EA, which evaluated the impacts as a result of natural fluctuation of the water level in Par Pond, and issued a Finding of No Significant Impact (DOE 1995b). Since January 1996, when DOE shut off the River Water System to Par Pond, the lake level has not fallen below the 199-foot (60.7-meter) level (Kirby 1996, 1997).

### 3.1 No-Action Alternative

As described above, the No-Action Alternative calls for DOE to continue the course of action it established as the result of an earlier NEPA evaluation, the *Environmental Assessment for the Natural Fluctuation of Water Level in Par Pond and Reduced Water Flow in Steel Creek Below L-Lake at the Savannah River Site* (DOE 1995a,b). The proposed action in that EA was to examine the need for continuing the operation

of the River Water System by (1) developing data needed to evaluate potential environmental impacts of a further reduction or elimination of flow demands from the system and (2) evaluating the potential of reducing operating costs by allowing the water level in Par Pond to fluctuate with reduced pumping. The proposed action in the environmental assessment also included a reduction of flow rates

from L-Lake to Steel Creek to natural stream flows while maintaining a full pool. In its Finding of No Significant Impact, DOE determined that, based on the information and analyses in the EA, the proposed action did not constitute a major Federal action that would significantly affect the quality of the human environment within the meaning of NEPA.

At present, the River Water System requires a staff of 7.8 full-time equivalent personnel and a visual security inspection once a day, and requires routine dredging of the intake canal from the Savannah River (Proveaux 1996). As indicated in Chapter 1, to save money (over \$1 million per year) and energy, DOE will purchase a small pump [approximately 5,000 gallons per minute (0.32 cubic meter per second)] to supply the current demand for river water. As detailed in Chapter 1, DOE assumed the use of this new pump, rather than one of the existing large pumps, in the evaluation of this No-Action Alternative. DOE will provide measures to minimize current use of the River Water System. In K- and L-Areas, DOE has replaced river-water-cooled air conditioning chillers with air-cooled systems and river water with well water for cooling air compressors. The operation of the system using the small pump described above would entail the following annual costs (WSRC 1996c):

<u>Item</u>	<u>Cost</u>
System maintenance	\$1,084,000
Dam (Par Pond and L-Lake) maintenance	520,000
Energy	<u>494,000</u>
Total	\$2,098,000

### 3.1.1 L-LAKE

Under the No-Action Alternative, the River Water System would continue to pump an average of 5,000 gallons per minute (0.32 cubic meter per second) and would supply river water

to K- and L-Reactors through their respective 186-Basins by way of 12 miles (19 kilometers) of underground concrete piping. In L-Area, outfall water from the reactor flows to L-Lake (WSRC 1996b). No Action in this EIS means that the River Water System would continue to pump an average of 5,000 gallons per minute (0.32 cubic meter per second) and that DOE would maintain L-Lake at full pool [i.e., 190 feet (57.9 meters) above mean sea level].

### 3.1.2 SRS STREAMS

Under the No-Action Alternative, reduced flow rates [i.e., no less than 10 cubic feet (0.28 cubic meter) per second] below the L-Lake and Par Pond dams would continue. In addition, the River Water System would continue to supply river water to loads in K- and L-Reactors. These loads include make-up water for fire protection in K- and L-Area basins and for blending of L-Area sanitary wastewater discharges. Flows from K- and L-Areas would continue to discharge to Indian Grave Branch and Pen Branch, and L-Lake and Steel Creek, respectively.

### 3.1.3 PAR POND

Under the No-Action Alternative, DOE would not pump river water to Par Pond, and the lake level would fluctuate near full pool [200 feet (61.0 meters) above mean sea level]. DOE has committed to a post-refill monitoring program that establishes threshold levels for the determination of impacts due to changes in hydrology (reservoir fluctuation performance), water quality, sediment contaminants, shore-zone macrophyte community, and fish populations as the reservoir water level fluctuates and the lake changes due to the lack of river water input (DOE 1995a). If any of these parameters exceeded established threshold levels, DOE would use the River Water System to pump water into the reservoir to an appropriate level greater than 195 feet (59.4 meters) above mean sea level to minimize impacts.

### 3.2 Shut Down and Deactivate the River Water System

This alternative would have two distinct phases: shutdown and deactivation. During the shutdown phase, DOE would perform the following activities:

- Secure River Water System facilities in C-, K-, L-, and P-Areas and the associated piping for personnel safety
- TC | • Secure Pumphouse 3G intake lines to prevent intrusion of water from the Savannah River
- TE | • Perform pumphouse cleanup activities necessary to satisfy concerns about releases of petroleum products or other chemicals that could affect the environment
- Leave the equipment in Pumphouse 3G with moving parts in the positions least susceptible to degradation
- Keep the L-Lake Dam intact with the outlet gates set to provide no less than 10 cubic feet (0.28 cubic meter) per second until the lake drained to the original natural flow of Steel Creek

The following costs would be associated with the shutdown phase (Jones 1996a; Jones 1997a; WSRC 1996b):

	<u>Item</u>	<u>Cost</u>
	System shutdown (one-time cost)	\$200,000
	Annual dam maintenance	520,000
TC	Annual labor (one full-time equivalent person to handle minor maintenance)	85,000
	Annual energy	<u>20,000</u>
TC	Total annual cost	\$625,000

DOE would complete the deactivation phase after the River Water System was completely through the shutdown phase and L-Lake had drained to the original condition of Steel Creek. DOE would limit surveillance or maintenance to Par Pond and would assume that no equipment

would be operable in the future. After the lake recedes, DOE would either breach the dam or  
TE | take other actions to ensure unobstructed flow at a cost in addition to those shown above to enable original stream flow conditions through the area with no further dam maintenance costs. This alternative would discontinue River Water System fire protection support for K- and L-Reactors. This make-up capacity would be provided by the existing K- and L-Area well water systems.

#### 3.2.1 L-LAKE

Under the Shut Down and Deactivate Alternative, DOE would shut down the River Water System, thereby pumping no water to L-Lake. The only water the lake would receive would be  
TE | through natural recharge. L-Lake would recede over approximately 10 years (Jones and Lamarre 1994), returning to the original stream flow conditions of Steel Creek. During this drawdown period, DOE would apply appropriate measures to minimize adverse effects of exposed sediments in the lakebed such as the following:

- Plant grass seed in exposed sediments to minimize the effects of erosion and exposure of contaminants in the lakebed
- Revegetate the upland areas with tree species by natural seeding and hand planting, if necessary
- TC | • Apply appropriate vegetation measures to accelerate the reversion of the lake to the original conditions of the Steel Creek floodplain
- Seed the upstream face of the dam and tie it into the embankment after the lake level drops below the top portion of the dam, which is protected by riprap

In addition, DOE would keep the outflow gates set to allow water to flow gradually to Steel Creek below the dam. During L-Lake drawdown, DOE would control the rate of drawdown to the extent possible by adjusting the outflow gates while maintaining 10 cubic feet (0.28 cubic meters) per second flow to Steel Creek. DOE would minimize drawdown of the lake during fall and winter months when the growth of stabilizing ground cover would be minimal. DOE may elect to drawdown L-Lake more quickly during the times when the receding water would expose steep banks that would be subject to erosion by wave action or when rapid natural growth of vegetation is assured.

During the period of L-Lake drawdown, DOE would take advantage of various research opportunities enabled by the transition of L-Lake from a lake system to its original stream ecosystem.

After Steel Creek reached its original flow conditions, DOE would either breach the dam or take the necessary actions to ensure continuous unobstructed flow through the existing outflow structure. The actions taken on the dam after L-Lake recedes would not occur in the near term (expected to be approximately 10 years after shutdown). Therefore, DOE considers this a connected action and does not evaluate the effects of alternative actions for the dam.

Additional actions concerning the future disposition of the dam would be subject to the appropriate level of NEPA review.

Natural Steel Creek flow is estimated to average 10 cubic feet (0.28 cubic meter) per second. This flow could not be augmented during low flow years.

### 3.2.2 SRS STREAMS

Under the Shut Down and Deactivate Alternative, DOE would shut down the River Water System, thereby supplying no river water to Steel Creek, Lower Three Runs, and other onsite streams. L-Lake would revert to stream conditions, but both Steel Creek and Lower Three Runs would receive flows which could support a diverse and biologically balanced fish community (WSRC 1993).

### 3.2.3 PAR POND

Under the Shut Down and Deactivate Alternative, DOE would not pump water to Par Pond. The only water the lake would receive would be through natural recharge. Because the River Water System would not be operating, man-made recharge would not be possible if the lake level fell below 195 feet (59.4 meters) above mean sea level.

## 3.3 Proposed Action - Shut Down and Maintain the River Water System

Sections 3.1 and 3.2 describe the bounds of reasonable alternatives. Under the No-Action Alternative, DOE would continue the current operation of the River Water System. Under the other bound, Shut Down and Deactivate, DOE would shut down and eventually abandon the system and would provide no surveillance and maintenance except that required to ensure safety and to avoid environmental releases of petroleum products or other chemicals. The DOE Proposed Action and Preferred Alternative, Shut Down and Maintain, is a middle ground under which DOE would shut the system

down, lay up all or portions of the system, and maintain some portions in a standby condition that would enable restart.

As indicated in Section 3.2.1, the cessation of river water input to L-Lake is likely to result in a gradual drawdown of the lake and its reversion to the original conditions of Steel Creek. During the drawdown period (about 10 years), DOE would apply measures to ensure that it could refill L-Lake safely and would apply the measures described in Section 3.2.1 to minimize adverse effects of exposed sediments in the

lakebed. DOE also would apply the measures described in Section 3.2.1 to control the rate of drawdown under this alternative. DOE could restart the system temporarily to eliminate drawdown during periods of slow regrowth. This alternative would require another water supply for fire protection. This make-up capacity would be provided by the existing K- and L-Area well water system.

A decision to implement the Proposed Action would require a corresponding decision on the type of layup that DOE would implement. For example, DOE could maintain the system in a way that enabled startup in a short period of time, or (at significantly less cost) it could shut down the system to the extent that it would take a long time to return the system to an operable condition. The following subsections contain examples of potential events that could lead to a decision to restart the River Water System if DOE selected and implemented the Proposed Action and layup schemes ranging from a high state of readiness (almost immediate startup with high annual surveillance and maintenance costs) to minimal surveillance and maintenance (requiring a long time period and significant expense to bring the system to operational readiness).

### 3.3.1 POTENTIAL DECISIONS TO RESTART THE RIVER WATER SYSTEM

DOE would shut down the River Water System, lay up all portions of the system, and maintain those portions in a standby condition that would enable restart. This status would continue until DOE was sure that maintenance in standby was unnecessary. DOE proposes to maintain the system because there could be future needs that require large quantities of water, making the restart of the system a feasible option. Should DOE determine in the future that it no longer desires to maintain the River Water System in a standby condition, DOE would issue a Record of Decision based on this EIS and deactivate the system.

Three examples of restarting the River Water System are presented below. DOE does not wish to imply that it expects to actually need to restart the system for the situations presented but has selected them to cover a range of actions that maintenance in standby would support (i.e., pump to L-Lake, Par Pond, or a new facility).

#### 3.3.1.1 Pump to Par Pond

Until final CERCLA remedial actions are determined and implemented, DOE would pump river water into Par Pond to bring the lake back to an appropriate level greater than 195 feet (59.4 meters) above mean sea level if any monitored parameter exceeded established threshold levels. DOE believes that the likelihood of exceedances or the lake level falling below 195 feet (59.4 meters) is very low. DOE used 10 years of rainfall data and applied a simulation model to estimate changes in the Par Pond water level, basing its estimates on natural surface water and groundwater inflows (i.e., no pumping) and a discharge of 5,000 gallons per minute (0.32 cubic meter per second), which is slightly greater than the required 10 cubic feet (0.28 cubic meter) per second to Lower Three Runs. DOE based its determination that the 10-cubic-foot-per-second discharge rate was appropriate on discharge/habitat relationships predicted by an instream flow model and information on fish assemblage structure. DOE believes that Par Pond would not fall below the 195 foot level unless there was a catastrophic drought that would affect water quality in other regional lakes and streams. Based on the 10-year record and the simulation model, this analysis predicted that the water level would be above 198.4 feet (60.5 meters) 75 percent of the time and the lowest level would be 196.6 feet (59.9 meters) (Gladden 1996a). Based on gaged data in calendar year 1996, the lowest daily lake level was 199.21 feet (61 meters) (Kirby 1997). Nevertheless, DOE prefers to maintain the River Water System after shutdown and, if necessary, it would restart the system, pump to Par Pond, and bring the water level to an appropriate level above 195 feet (60 meters).

Under the Proposed Action, DOE could bring the water level back to an appropriate level above 195 feet (59.4 meters) above mean sea level by restarting the River Water System. This would require restart of at least one of the large system pumps. A layup option requiring a short time to resume pumping would be preferred. Otherwise, DOE would initiate system restart before a monitored parameter exceeded an established threshold level [i.e., if it observed that drought conditions would be likely to persist and the lake level was approaching the lower bounding limit of 195 feet (59.4 meters)].

### 3.3.1.2 Refill L-Lake

In accordance with the Federal Facility Agreement (FFA) between DOE, the U.S. Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (EPA 1993a), DOE has prepared an internal draft remedial site evaluation report for L-Lake. The report contains recommendations on the need for further investigation of the lake under the FFA. In the unlikely event that the decision under the FFA process included refilling the lake to an appropriate level, DOE would then restart the River Water System to refill L-Lake. The time required to restart the system would not be critical, but this decision would require a substantial quantity of water. For example, using two 25,000-gallon-per-minute (1.6-cubic-meter-per-second) pumps to fill an empty L-Lake to its normal pool while continuing to release 10 cubic feet (0.28 cubic meter) per second to Steel Creek would take approximately 4 months. After refilling the lake, DOE would run the small pump [approximately 5,000 gallons per minute (0.32 cubic meter per second)] continuously to maintain the lake level and downstream releases.

### 3.3.1.3 Support New Missions

Although the current SRS mission emphasis is cleanup and environmental restoration, DOE could initiate new defense-related, industrial, or other missions that would require large quantities of water that the River Water System could

provide. For example, in the Tritium Supply and Recycling Programmatic EIS, DOE evaluated an alternative which would produce tritium in an accelerator. In the associated Record of Decision, DOE announced its intention to pursue a dual track involving the two most promising tritium supply alternatives: (1) an existing or partially complete commercial reactor and (2) accelerator production of tritium. The Record of Decision also selected the SRS as the location for an accelerator, if DOE decides to build one. By 1998, DOE will select the primary source of tritium and thereafter will develop the other alternative as a backup tritium source, if feasible (60 FR 63878-63891).

DOE plans to prepare project-level EISs for these potential projects (see *Notice of Intent, Accelerator Production of Tritium at the Savannah River Site Environmental Impact Statement*, 60 FR 46787-46790). The optimum use of the River Water System, if any, would be part of the project design for an accelerator. At present, three of the plans for supplying cooling water to an accelerator involve the use of the system. The preferred plan would use the pumphouse, two replacement pumps, and an existing distribution line to get as close as possible to the project site, and then would construct a smaller pipe to carry make-up water to recirculating cooling towers at the accelerator [preliminary calculations indicate that approximately 6,000 gallons per minute (0.38 cubic meter per second) of make-up water would supply the peak demand] (WSRC 1996d). The second plan would use the existing pumphouse, pumps, and distribution system, then would construct a new, large-diameter pipe to carry water to once-through heat exchangers at the accelerator [preliminary calculations indicate that this alternative would require approximately 125,000 gallons per minute (7.9 cubic meters per second)]. The third option would use the K-Reactor cooling tower and portions of River Water System piping.

Shutting down and maintaining the River Water System could preserve its availability for such new missions as the accelerator project. The

second plan described above would necessitate a far more extensive restart mission. Nevertheless, DOE could accomplish the required upgrades and replacements over an extended period of time (30 months), and the system would be available when the accelerator project was ready to use the cooling water supply.

### 3.3.2 LAYUP OPTIONS

River Water System operations personnel prepared cost estimates for the potential shutdown and restart of the system for several combinations of restart reliability (high risk/low reliability versus low risk/high reliability), layup schemes [pipes full using the small 5,000-gallon-per-minute (0.32-cubic-meter-per-second) pump versus pipes full using a still smaller jockey pump versus dry pipe], and levels of operational readiness (restart within 1, 6, 12, and 30 months) (WSRC 1996c). From these combinations, DOE selected options that were reasonable for its Preferred Alternative, Shut Down and Maintain.

DOE eliminated high risk/low reliability because it would want assurance of restart capability if it decided to restart the system. The three layup schemes are reasonable, but they vary in cost and the operational readiness they could support. For example, the small-pump layup scheme is the only one that could support restart within 1 month; system startup under the dry pipe scheme would require 30 months. Surveillance, maintenance, and restart costs are sensitive to the level of operational readiness. High operational readiness (restart in 1 month) would provide no cost advantage over operating under the No-Action Alternative, while layup under schemes calling for restart within 30 months would save nearly \$1.5 million per year.

The following bases for the analysis are important for a comparison of the layup and restart options:

- Costs presented for implementing each layup option are for comparison only. Because DOE has not developed detailed proj-

ect plans for the layup and restart options, they are only preliminary estimates of probable cost. However, because DOE used a consistent set of assumptions to develop the costs for each option, they provide a reasonable basis for comparison.

- Costs are in 1996 dollars without an escalation or discount rate. The restart costs assume that the River Water System would be shut down for 3 to 5 years before DOE decided to restore or restart it. As the shutdown time lengthened, replacement costs would increase.

- In the base case, all layup schemes would maintain two large pumps with a combined capacity of 50,000 gallons per minute (3.2 cubic meters per second), and would permanently shut down the water line to R-Area and would not bring it back up. These layup schemes would not support the demand for the once-through heat exchangers at the accelerator, and the R-Area line is the line DOE would use for either river water alternative for the accelerator. Therefore, the base case estimates do not serve as a guide for the accelerator examples. As stated above, the optimum use of the River Water System, if any, would be part of the project design for the accelerator.

- As stated above, the optimum use of the River Water System, if any, would be part of the project design for the accelerator. However, DOE has estimated the additional cost for maintaining the water line to R-Area to support the preferred recirculating cooling tower plan or the once-through heat exchanger plan. It has also estimated the additional cost of maintaining eight large pumps that would supply river water to the once-through heat exchangers.

- With the wet layup schemes (small 5,000 gallon-per-minute pump or jockey pump), excess water above that needed to keep the system pressurized will be discharged to an appropriate outfall. The small pump layup scheme could maintain L-Lake at its normal operating level [190 feet (58 meters)]. Dis-

charge from the jockey pump would be insufficient to maintain lake level.

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- The analysis does not include procurement and installation costs for the jockey and small pumps. The small pump and its estimated 800-horsepower motor will be available for each layup scheme and, therefore, should not be part of this cost analysis.

Table 3-1 lists the results of the base case restart readiness/layup scheme for the low risk/high reliability options. The sections that follow the table discuss each combination.

DOE assumes that dam maintenance, which includes both L-Lake and Par Pond dams, would be constant (\$520,000 per year) for all combinations. In addition, there is a trend toward lower annual costs of layup and higher restart cost as readiness decreases (i.e., increased time to restart). If DOE did not restart the system during the layup period, the Shut Down and Deactivate Alternative would be less costly than the layup combinations listed in Table 3-1.

### 3.3.2.1 Restart in 1 Month

- Small Pump – Only the small-pump scheme would support a restart within 1 month. Pumping would be continuous and essentially equivalent to activities under the No-

Action Alternative. Because this option would not meet the purpose and need for the shutdown action (i.e., cost savings), it is not a reasonable option for the Proposed Action to shut down the River Water System and maintain it in standby.

### 3.3.2.2 Restart in 6 Months

- Small Pump – The small-pump scheme to support a restart within 6 months would be equal in cost to a 1-month restart, and DOE has dismissed it as an unreasonable option for the Proposed Action.
- Jockey Pump – If DOE desired this high degree of operational readiness (restart in 6 months), it would save about \$300,000 per year in electricity. A 6-month restart scheme would require a wet layup. This means the jockey pump would run continuously and the two large pumps that DOE is maintaining would run 24 hours per month to keep the system pressurized. The estimated savings in electricity would pay for the jockey pump in about 2 years of layup. Because the need to replace equipment is not likely under this intense surveillance and maintenance option, restart costs would be zero. Most restart actions would not require a startup time this fast. It would,

**Table 3-1.** Maintenance and restart costs of layup options - base case.

Time to restart	Layup scheme	Annual Costs (\$ million per year)				One-time cost for restart (\$ million)
		Electricity	System surveillance and maintenance	L-Lake and Par Pond dam maintenance	Total annual cost	
1 month	Small pump	0.494	1.084	0.520	2.098	0.000
6 months	Small pump	0.494	1.084	0.520	2.098	0.000
	Jockey pump	0.164	1.084	0.520	1.768	0.000
12 months	Small pump	0.401	0.865	0.520	1.786	0.552
	Jockey pump	0.071	0.710	0.520	1.301	0.812
30 months	Small pump	0.401	0.865	0.520	1.786	0.560
	Jockey pump	0.071	0.710	0.520	1.301	0.820
	Dry layup	0.044	0.085	0.520	0.649	4.730

however, enable DOE to respond quickly to water needs at Par Pond.

### 3.3.2.3 Restart in 12 Months

As in the 6-month restart options, only wet layup schemes could support restart in 12 months. Under both schemes, continuous pumping would keep the system pressurized. However, system operations personnel would rotate the two large pumps in standby by hand and would not operate them. This option would result in lower electricity and system maintenance costs in comparison to the corresponding 6-month restart schemes, but there would also be restart costs.

- **Small Pump** – In relation to No Action, the small-pump scheme and 12-month startup would save about \$300,000 per year but would require approximately \$550,000 for restart. If DOE kept the system shut down for more than 2 years, the costs to maintain and restart would be less than the costs to operate under the No-Action Alternative. Both No Action alternative and this layup scheme could maintain L-Lake.
- **Jockey Pump** – The total annual cost for the jockey pump scheme would be approximately \$485,000 less than the cost for the small pump scheme for the 1-year-to-restart case, but restart costs would be an additional \$260,000. Given a reasonable period of layup the jockey pump option would have a lower cost. For example, for a 5-year layup period the total cost for layup and restart would be approximately \$9.5 million ( $1.786 \times 5 + 0.552$ ) for the small-pump scheme and approximately \$7.3 million ( $1.301 \times 5 + 0.812$ ) for the jockey pump scheme.

### 3.3.2.4 Restart in 30 Months

The wet pipe layup schemes and the dry pipe scheme could support restart in 30 months.

- **Small-Pump** – This option would have the same annual layup costs as the corresponding 12-month restart option.
- **Jockey Pump** – As in the 12-month restart options, the jockey pump scheme is better than the small-pump scheme with respect to cost because the lower annual costs during layup quickly offset the higher cost to restart the system.
- **Dry Layup** – The characteristics of the dry pipe layup and restart scheme are low annual costs for electricity, surveillance, and maintenance but high costs for restart. Under this scheme, DOE would maintain building electricity as it would in all layup combinations but would not maintain right of way; fallen trees would be cleared but no brush would be cut. System operations personnel estimate that this scheme would require the replacement of 1 mile (1.6 kilometers) of pipe, which would account for \$2 million of the \$4.7 million restart cost.

DOE compared layup and restart costs for the jockey and dry pipe schemes. For layup periods of less than 6 years, the relatively low startup costs for the jockey pump scheme would make its total layup and restart costs less than those for the dry pipe scheme. For layup periods of 6 years or more, the relatively low annual costs of layup for the dry pipe scheme would dominate and its total cost of layup and restart would be less than those for the jockey pump scheme. Table 3-2 summarizes the tradeoffs between the two schemes and compares both to the cost of operation under No Action.

**Table 3-2.** Cumulative costs to lay up, restart (within 30 months), and operate the River Water System (layup period in years; costs in millions of dollars).

Layup period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Operation (No Action)	2.1	4.2	6.3	8.4	10.5	12.6	14.7	16.8	18.9	21.0	23.1	25.2	27.3	29.4	31.5
Jockey pump	2.1	3.4	4.7	6.0	7.3	8.6	9.9	11.2	12.5	13.8	15.1	16.4	17.7	19.0	20.3
Dry pipe	5.4	6.0	6.7	7.3	8.0	8.6	9.3	9.9	10.6	11.2	11.9	12.5	13.2	13.8	14.5
Jockey pump savings	0.0	0.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	7.9	8.7	9.5	10.3	11.1
Dry pipe savings	-3.3	-1.8	-0.4	1.1	2.5	4.0	5.4	6.9	8.3	9.8	11.2	12.7	14.1	15.6	17.0

### 3.3.2.5 Additional Costs to Support Use of the River Water System for Accelerator Production of Tritium

As stated for base case layup options, DOE would permanently shutdown the water line to R-Area (i.e., the R-Normal Line) and would not reactivate it if the system is restarted. In its selection of a restart option, DOE would evaluate the additional cost of maintaining the R-Normal Line for a short period of time until the decision on whether or not to construct the accelerator for production of tritium is made (DOE expects to make this decision by 1998).

If DOE wants to ensure the capability to support the preferred recirculating cooling tower option,

it would not need to change its layup options except for increased surveillance and maintenance of the R-Normal Line. The increased cost is expected to be \$10,000 per year for the dry pipe scheme and \$35,000 per year for the wet pipe schemes (Jones 1997b).

If DOE also wishes to ensure the capability to support the once-through heat-exchanger option, it would maintain eight large pumps to be available to supply the 125,000 gallons per minute once-through flow. This would increase the costs for electricity, maintenance, and restart. Table 3-3 presents the increased costs to support this option, including surveillance and maintenance of the R-Normal Line.

**Table 3-3.** Additional cost to maintain R-Normal Line and 125,000 gallon-per-minute pumping capacity.

Time to restart	Layup scheme	Annual Costs (\$ million per year)				One-time cost for restart (\$ million)
		Electricity	System surveillance and maintenance	L-Lake and Par Pond dam maintenance	Total annual cost	
1 month	Small pump	0.020	0.135	0.000	0.155	0.000
6 months	Small pump	0.020	0.135	0.000	0.155	0.000
	Jockey pump	0.020	0.135	0.000	0.155	0.000
12 months	Small pump	0.020	0.140	0.000	0.160	0.806
	Jockey pump	0.020	0.135	0.000	0.155	0.896
30 months	Small pump	0.020	0.140	0.000	0.160	0.830
	Jockey pump	0.020	0.135	0.000	0.155	0.920
	Dry layup	0.006	0.040	0.000	0.046	2.368

Source: Jones (1997c).

### 3.3.3 ADDITIONAL COSTS FOR THE SHUTDOWN AND MAINTAIN ALTERNATIVE

DOE has considered additional costs to implement the Shutdown and Maintain Alternative. They include monitoring and restoration costs incurred by the L-Lake drawdown and an alternative to river system blending water for sanitary wastewater effluents in L-Area. These costs are as follows:

- Septic tank and tile field installation: \$70,100; annual operation and maintenance: \$120.

Other alternatives to River Water System blending are in Section 4.1.2.

- Monitoring and restoration costs during L-Lake drawdown are estimated to average \$190,000 per year for approximately 10 years.

This cost is a preliminary estimate of probable cost. The preliminary estimates range from \$125,000 per year to \$300,000 per year depending on the extent of stabilization,

revegetation, and monitoring. If DOE selects a shutdown alternative, it will prepare a detailed monitoring and restoration implementation plan that will enable costs to be estimated with greater accuracy.

Costs for investigation and potential remedial actions for L-Lake would be incurred regardless of the decision on the River Water System.

DOE believes that the reversion of L-Lake to pre-SRS Steel Creek conditions would enhance the efficiency of the investigation and remedial action under the FFA. The costs for alternative remedial actions for a drained lake are presented in Appendix A and summarized in Table 3-4.

DOE believes that institutional controls to prevent residential use of the L-Lake lakebed for a period of time that allows for natural radiological decay of the contaminants to safe levels is more cost effective and reasonable than maintaining the 40-year-old River Water System and incurring the cost to maintain L-Lake water level for a long (perhaps 100 years) period of time. For the benefit of readers who do not wish to study the appendixes, costs estimates for various remedial options are presented below.

**Table 3-4.** Costs for various remedial options in accordance with the Federal Facility Agreement.

Remedial option	Onsite worker (risk = $10^{-4}$ )	Onsite worker (risk = $10^{-6}$ )	Future resident (risk = $10^{-4}$ )	Future resident (risk = $10^{-6}$ )
No action	No cost	No cost	No cost	No cost
Institutional control	No cost	\$10,000	\$15,000	\$15,000
Soil cover	No cost	\$100,000	\$29.7 million	\$131 million
Excavation	No cost	\$1.4 million	\$380 million	\$1.7 billion

## 3.4 Comparison of Environmental Impacts

This EIS evaluates alternative actions for the River Water System at the SRS. The alternatives cover the spectrum of reasonable actions from continued operation (No Action) to complete shutdown and deactivation (Shut Down and Deactivate). The DOE Proposed Action and Preferred Alternative is a middle ground under which DOE would shut the system down, lay up all or portions of the system, and main-

tain some portions in a standby condition that would enable restart.

The alternatives vary substantially in achieving the purpose and need for DOE action, costs to operate or maintain the system, commitment of resources, and environmental consequences.

Table 3-5 compares basic operational characteristics of the alternatives.

**Table 3-5.** Characteristics of the alternatives.

Data	No Action	Shut Down and Deactivate	Shut Down and Maintain	
	Small pump	No pumping	Jockey pump <sup>a</sup>	Dry layup <sup>b</sup>
Replacement/restart one-time cost <sup>c</sup>	NA <sup>d</sup>	NA	\$820,000	\$4,730,000
Time to restart	NA	NA	30 months	30 months
<b>Cost of Operation</b>		\$200,000 <sup>e</sup>		
System surveillance and maintenance	\$1,084,000	\$85,000 <sup>f</sup>	\$710,000	\$85,000
L-Lake, Par Pond Dam surveillance and maintenance	520,000	\$520,000 <sup>g</sup>	520,000	520,000
Energy costs	494,000	20,000	71,000	44,000
Total annual cost	\$2,098,000 <sup>h</sup>	\$625,000	\$1,301,000	\$649,000
Staff required <sup>i</sup>	7.8	1	6	1
Security (included in total costs)	Visual inspection 1/day	Visual inspection 1/day	Visual inspection 1/day	Visual inspection 1/day
Regulatory requirements	Intake canal dredging	None	Dredging <sup>j</sup> SCDHEC <sup>k</sup> permit for spoils	Dredging SCDHEC permit for spoils
Volume of water pumped	5,000-gallon-per-minute average	NA	Low flow to keep piping system pressurized	0

a. The piping system would stay pressurized by operation of a very small pump called a jockey pump.

b. The piping system would be drained.

c. One-time cost to restart (high reliability).

d. NA = not applicable.

e. One-time cost to shut down.

f. One full-time equivalent person to handle minor maintenance.

g. This is an annual cost for L-Lake and Par Pond dams. After L-Lake has receded and the dam is breached, annual dam maintenance costs for L-Lake will be \$0.

h. This cost does not include unexpected repair or replacement of the system.

i. Staff salary and overhead are included in system and dam maintenance cost.

j. Above costs do not include cost (if any) for re-permitting for dredging or reuse of existing spoil areas.

k. SCDHEC = South Carolina Department of Health and Environmental Control.

Table 3-6 summarizes and compares potential environmental impacts of the alternatives. The intent of this table is to draw from the detailed sections on affected environment and environmental impacts to present the primary impacts of the Proposed Action and alternatives in comparative form. The following statements form the bases of the results reported in this table:

- DOE will operate a 5,000-gallon-per-minute (0.32-cubic-meter-per-second) pump as a way to save money and energy. In this EIS, flows and cost comparisons described under

the No-Action Alternative reflect operation of the small pump.

- Under the shutdown alternatives, DOE would implement alternative sources for the river water required under No Action except that DOE would not provide water to L-Lake to maintain its water level. These requirements are reflected as an incremental impact of shutdown relative to No Action.
- Analyses indicate that L-Lake cannot maintain its normal pool level without flow augmentation from the River Water System.

To ensure that impacts of the shutdown alternatives are not underestimated, DOE assumes a worst-case situation where L-Lake continues to recede until it reaches the original Steel Creek surface water profile.

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System to respond to potential future needs, impacts under the Shut Down and Deactivate Alternative are equal to those of the DOE Proposed Action and Preferred Alternative, Shut Down and Maintain.

- With the exception of capability under the Proposed Action to restart the River Water

**Table 3-6. Comparison of the impacts of the alternatives for the River Water System.**

Resource	No-Action Alternative	Shutdown Alternatives
<b>Geology and Soils</b>		
Castor Creek (tributary to Fourmile Branch) and headwaters of Steel Creek (upstream of L-Lake)	Minimal soil erosion from vegetated slopes and natural flows	Same as No-Action Alternative.
Indian Grave Branch (tributary to Pen Branch)	Minimal soil erosion from vegetated slopes carrying natural flows and river water and well water discharges from K-Area	Same as No-Action Alternative except well water would replace river water discharge.
Steel Creek and Lower Three Runs (below dams)	Minimal erosion and sedimentation rates due to controlled stream flow	Same as No-Action Alternative for Lower Three Runs and Steel Creek while L-Lake drains, after which Steel Creek flows would be variable and uncontrolled and would experience moderate erosion and sedimentation from lakebed.
L-Lake and Par Pond	Minimal erosion due to constant normal pool water elevations in L-Lake and small fluctuations in Par Pond	Minimal remobilization of soils potentially contaminated by preimpoundment activities due to gradual recession of L-Lake; same as No-Action Alternative in Par Pond.
<b>Surface Water</b>		
Par Pond	Par Pond ecosystem would revert to that typically found in reservoirs in Southeast due to reduction of nutrients from Savannah River; DOE could resume pumping to Par Pond if conditions warranted	Reversion to typical southeastern reservoir, as with No-Action Alternative; under Shut Down and Maintain, DOE could prepare system for operation, then restart system to pump to Par Pond; no capability to pump under Shut Down and Deactivate.
L-Lake	Water level sustained by as much as 4,800 gpm <sup>a</sup> of river water pumped to and discharged from L-Area	Reversion to stream conditions with potential for lakebed erosion.

Table 3-6. (continued).

Resource	No-Action Alternative	Shutdown Alternatives	
L-Lake water quality	Dissolved oxygen in epilimnion seldom would fall below 5 milligrams per liter and would generally be greater than 1 milligram per liter in hypolimnion. Lowest temperatures would be around 50°F (10°C); maximum near-surface summer temperatures would be around 86°F (30°C); acidity would not be substantial; pH levels in near-surface water would seldom fall below 6.	Reduction in dissolved oxygen and temperature and increased acidity in epilimnion and hypolimnion of L-Lake until lake is drained.	
Steel Creek	Minimal siltation due to intake structure drawing water that would be low in suspended solids from top of lake; flow of 10 cfs <sup>b</sup> would be sustained	The dam is expected to act as a sedimentation basin, thereby minimizing siltation below dam.	TC
L-Area sanitary wastewater treatment plant	Blending flows would be supplied by river water pumping to L-Area	Alternate compliance method (e.g., septic tanks) would be required.	
L-Area cooling water discharges	L-Area 186-Basin maintained full for fire protection and overflowing for discharges to L-Lake; well water or river water could supply 190 gpm of cooling water for compressors	Alternate supply (e.g., well water) would be required for fire protection and compressor cooling; total well water requirement would be 390 gpm; total discharge to L-Lake would be reduced by 10 gpm evaporation from the 186-Basin to approximately 380 gpm.	
K-Area cooling water discharges	As much as 200 gpm pumped from system to K-Area 186-Basin for fire protection; well water would supply 210 gpm of cooling water for compressors	Alternate supply (e.g., well water) would be required for fire protection; same as No-Action Alternative for compressor cooling water; total discharge to Indian Grave Branch would be approximately 400 gpm (i.e., 200+210 less evaporation).	
Groundwater			
Water table levels in L-Area	With downgradient elevation of Water Table Aquifer controlled by lake level, it would stand at 190 ft <sup>c</sup> above mean sea level; Water Table Aquifer elevation at L-Area Oil and Chemical Basin (one of four nearby CERCLA <sup>d</sup> units) would be approximately 208 ft	As L-Lake recedes, water table elevations would drop 10 ft at Steel Creek outcrop (estimated 180 ft); at L-Area Oil and Chemical Basin, water table elevations would drop approximately 4 ft (estimated 204 ft); hydraulic gradients at CERCLA units would increase resulting in a 12-percent increase in local velocities. After lake level dropped, it would take approximately 18 years for contaminated groundwater to travel from CERCLA units to Steel Creek. Therefore, there would be little, if any, effect on remedial actions for these units.	
Air			
Air toxic - Mercury	0.014 microgram per cubic meter	Increased by $1.15 \times 10^{-6}$ microgram per cubic meter to approximately 6 percent of regulatory standard.	

**Table 3-6. (continued).**

	Resource	No-Action Alternative	Shutdown Alternatives
TC	Air toxic - Manganese	0.821 microgram per cubic meter	Increased by $2.6 \times 10^{-6}$ microgram per cubic meter to approximately 3 percent of regulatory standard.
	Criteria pollutant - 24-hour $PM_{10}$ concentration at SRS boundary	SRS sources plus background = 113 micrograms per cubic meter at the SRS boundary	Increase of 16 for a total of 129 micrograms per cubic meter at the SRS boundary, which is 85.7 percent of regulatory standard.
TC	Radionuclides - annual effective inhalation dose equivalent to maximally exposed offsite individual	Very small dose (0.02 millirem/yr)	Total dose from all pathways $6.5 \times 10^{-3}$ (mrem/yr); 0.07 percent of regulatory standard.
<b>Terrestrial Ecology</b>			
TE	L-Lake	No reduction in habitat for amphibians, reptiles, semiaquatic mammals, wading birds, and waterfowl in L-Lake	Reduction in habitat for amphibians, reptiles, semiaquatic mammals, wading birds, and waterfowl as L-Lake recedes.
		L-Lake amphibians, reptiles, semiaquatic mammals, wading birds, and waterfowl would be protected from predation	L-Lake amphibians, reptiles, semiaquatic mammals, wading birds, and waterfowl would be more vulnerable to predation as reservoir recedes.
		No increased exposure to contaminated L-Lake sediments	Animals foraging in the lakebed after draw-down would be exposed to contaminated sediments via inhalation, ingestion, and dermal contact.
<b>Aquatic Ecology</b>			
	L-Lake	Natural changes in aquatic communities as L-Lake ages	Reservoir ecosystem replaced by small stream ecosystem.
	SRS streams	Natural flows in small watersheds support few benthic organisms and fish in Indian Grave Branch	Same as No-Action Alternative.
<b>Wetlands</b>			
	L-Lake	Natural successional changes in littoral zone plant communities	Loss of submerged and floating-leaved aquatic plants as reservoir recedes; emergent species could move downslope with lake level.
	Par Pond	Changes in species composition of littoral-zone plants; acreage could be reduced	Same as No-Action Alternative.
TC	Steel Creek	With 10 cfs flow requirement, scrub-shrub vegetation would become more prevalent in stream corridor; willow probably would predominate. Over time, hardwood species would become established in delta, replacing swamp (cypress-gum) forest with deciduous hardwood (oak-elm-sweetgum) forest.	Same as No-Action Alternative during draw-down; after drawdown, natural flows would vary, averaging 10 cfs.

Table 3-6. (continued).

Resource	No-Action Alternative	Shutdown Alternatives	
Lower Three Runs	Readjustment of stream and bottomland ecosystems associated with continuation of existing flow requirements	Same as No-Action Alternative.	
<b>Threatened and Endangered Species</b>			
Bald eagles	Bald eagles nesting at Pen Branch would continue to forage around L-Lake	Bald eagles nesting at Pen Branch would in time lose primary foraging habitat (L-Lake) and could leave area.	
Wood storks	Foraging on SRS would continue	Wood storks could be exposed to increased levels of contaminants if L-Lake dropped rapidly and fish were trapped in small pools (primarily in spring and summer, when wood storks forage on SRS).	TC
Alligators	Alligators would continue to be present in L-Lake	L-Lake alligators would, in time, be displaced; drawdown of L-Lake could result in loss of nests, eggs, or hatchlings, depending on timing and rapidity of drawdown.	
<b>Occupational Health</b>			
Radiological - annual probability of fatal cancer to current involved worker (annual fatal cancer risk from all causes is $3.4 \times 10^{-3}$ ) <sup>e</sup>	$1.7 \times 10^{-7}$	$1.7 \times 10^{-7}$	TC
Radiological - number of lifetime fatal cancers to current SRS involved workers (16 lifetime fatal cancers from all causes expected in current SRS involved worker population) <sup>e</sup>	$5.5 \times 10^{-5}$	$5.5 \times 10^{-5}$	TE
Nonradiological - annual probability of fatal cancer to current SRS involved worker (annual fatal cancer risk from all causes is $3.4 \times 10^{-3}$ ) <sup>e</sup>	$2.5 \times 10^{-8}$	$1.4 \times 10^{-6}$	TC
<b>Public Health</b>			
Radiological - annual probability of fatal cancer to off-site maximally exposed individual (annual fatal cancer risk from all causes is $3.4 \times 10^{-3}$ ) <sup>e</sup>	$3.3 \times 10^{-9}$	$3.5 \times 10^{-9}$	TC

**Table 3-6. (continued).**

	Resource	No-Action Alternative	Shutdown Alternatives
TC	Radiological - number of lifetime fatal cancers to offsite population (157,900 lifetime fatal cancers from all causes expected in the offsite population living within 50 miles of SRS) <sup>e</sup>	$5.0 \times 10^{-5}$	$4.9 \times 10^{-5}$
TC	Nonradiological - annual probability of fatal cancer to offsite maximally exposed individual (annual fatal risk from all causes is $3.4 \times 10^{-3}$ ) <sup>e</sup>	None	$7.9 \times 10^{-9}$

**Land Use**

Onsite	Site facilities, natural vegetation types with more than 73 percent in forest land	Same as No-Action Alternative
Adjacent land	Used mainly for forest, agricultural, and industrial purposes	Same as No-Action Alternative

**Aesthetics**

TE L12-09	L-Lake	1,000-acre reservoir with wetlands along shoreline and abundance of wading birds, turtles, and some alligators	As L-Lake recedes, dried mud flats would appear for periods of time until revegetation began; could be seen by 1,800 SRS workers who pass by daily.
TC	Par Pond	2,640-acre reservoir with wetlands along shoreline, pine and hardwood forests up slope; abundance of amphibians, reptiles, wading birds, and waterfowl (in winter); water level fluctuates while discharge from Par Pond is controlled.	Same as No-Action Alternative
	SRS streams	Narrow streams at headwaters broadening into wide swampy deltas at Savannah River; abundant hardwood and wetland vegetation with variety of wildlife; 10 cfs in Lower Three Runs and Steel Creek downstream of dams; natural flow in Fourmile Branch and Steel Creek above L-Lake; natural flow plus small cooling water discharges to Indian Grave Branch/Pen Branch	Same as No-Action Alternative

a. gpm = gallons per minute; to convert to cubic meters per second, multiply by 0.000063088.

b. cfs = cubic feet per second; to convert to cubic meters per second, multiply by 0.028317.

c. ft = feet; to convert to meters, multiply by 0.3048.

TE d. CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.

e. Based on fatal cancer incidence in general population of 235 per 1,000 and a 70-year life expectancy.